

## CLAIMS

What is claimed is:

1           1.    A semiconductor laser, comprising:  
2           a first optical gain element that generates a first  
3   light beam having a first optical frequency;  
4           a second optical gain element that generates a second  
5   light beam having a second optical frequency;  
6           an optical frequency mixer that is coupled to said  
7   first and second gain elements and generates a polarization  
8   wave at a third optical frequency; and  
9           a near-field phase grating that couples a power from  
10   the polarization wave to an electromagnetic wave  
11   propagating at the third optical frequency.

1           2.    The laser of claim 1, wherein the third optical  
2   frequency is in the mid-infrared, long-infrared or  
3   Terahertz regions.

1           3.    The laser of claim 1, wherein said optical  
2   frequency mixer includes a waveguide optically coupled to  
3   said first and second gain elements.

1        4.    The laser of claim 1, wherein the electromagnetic  
2 wave propagates in a direction essentially perpendicular to  
3 a propagation direction of the first and second light  
4 beams.

1        5.    The laser of claim 1, wherein the semiconductor  
2 laser is fabricated with group III-V material.

1        6.    A semiconductor laser, comprising:  
2        a first optical gain element that generates a first  
3 light beam having a first frequency;  
4        a second optical gain element that generates a second  
5 light beam having a second frequency;  
6        mixing means for mixing the two light beams to create a  
7 polarization wave at a third optical frequency, and;  
8        means for coupling a power of the polarization wave to  
9 an electromagnetic wave propagating at the third optical  
10 frequency.

1        7.    The laser of claim 6, wherein the third optical  
2 frequency is in mid-infrared, long-infrared or Terahertz  
3 regions.

1        8.    The laser of claim 6, wherein said mixing means  
2 includes a waveguide for mixing said first and second light  
3 beams.

1        9.    The laser of claim 6, wherein the electromagnetic  
2 wave propagates in a direction essentially perpendicular to  
3 a propagation direction of the first and second light  
4 beams.

1        10.   The laser of claim 6, wherein the semiconductor  
2 laser is fabricated with group III-V material.

1        11.   A method for operating a semiconductor laser,  
2 comprising:  
3        generating a first light beam having a first optical  
4 frequency;  
5        generating a second light beam having a second optical  
6 frequency;  
7        mixing the two light beams to create a polarization  
8 wave at a third optical frequency, and,

9           coupling a power of the polarization wave to an  
10 electromagnetic wave propogating at the third optical  
11 frequency.

1           12. The method of claim 11, wherein the third optical  
2 frequency is in the mid-infrared, long-infrared or  
3 Terahertz regions.

1           13. The method of claim 11, wherein the first and  
2 second light beams are mixed in a waveguide.

1           14. The method of claim 11, wherein the  
2 electromagnetic wave propagates in a direction essentially  
3 perpendicular to a propagation direction of the first and  
4 second light beams.